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TABLE OF CONTENTS

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FOREWORD

THIS number of the REVIEW is the seventh in the series dealing with growth and development. The current number shows a continuation of the trends first noted about a decade ago; namely (1) an increased interest in research pertaining to the personal, social, and physiological aspects of development, and (2) a declining interest in research pertaining to mental and motor development.

The triennium covered by this number of the growth and development series may be characterized by (1) prolific writing, especially in the area of personal, social, and physiological aspects of development, but with no startling positive results; (2) an increasing interest in changes which take place in later life; (3) the absence of basically new tools, new techniques, new methods of analysis and procedure—with but few exceptions, the studies reported in this number of the REVIEW are repetitions of, or elaborations upon, similar studies reported earlier; and (4) a wide variation in the quality of research reported—unfortunately, the outstandingly good pieces of research are not numerous.

In line with policies established by previous committees on Growth and Development, the current number has excluded numerous studies dealing with specific manual skills where there is no consideration of changes with age. With the exception of a few in which there is a definite contribution to an understanding of the normal aging processes, studies involving clinical cases, in general, have not been included.

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CHAPTER I

Mental Development from Birth to Preadolescence

DEAN A. WORCESTER

Introduction

THE number of significant investigations available for review in the area covered by this chapter is somewhat less than that reported in previous reviews. Moreover, it appears that in the last three years there have not been any markedly new lines of research on the intellectual development during infancy and childhood. Almost all of the studies examined would fall into classifications similar to those used in earlier reviews. During the period of this review the effects of culture, schooling, or drugs on intelligence were still under investigation and controversies on these points were still active. If there was a change of emphasis in research, it was perhaps in the direction of determining the effects of physical conditions upon development, and in discovering the ways in which individuals of differing mental abilities respond to certain situations.

The quality of research reported was variable. New tools and refined statistical technics were employed in many quarters, but in the opinion of the writer, questionable procedures were still too much in evidence.

Tests and Testing

A few new tests of mental development have appeared during the period of this review, and a number of studies have been made involving special applications of existing measures. Several volumes describing tests, testing procedures, and principles underlying testing have appeared in this period. Among these were those of Buros (12), Cronbach (13), Freeman (17), Goodenough (20), Mursell (34), and Sarason (35).

Use of a new type of test, the *Full Range Picture Vocabulary Test*, was reported by Ammons, Arnold, and Herrman (2) and by Ammons and Holmes (3). This test covering preschool to adult levels presents a series of plates to which the individual tested responds by indicating the picture which illustrates a given word. Since the indication can be given by any means possessed by the subject tested, it is suggested for use with the cerebral palsied. Tracht (40) demonstrated the possibility of the use of the *Progressive Matrices* with the cerebral palsied. Gilliland (19) gave detailed evidence of the validity of the *Northwestern Infant Intelligence Test*, and held that infant tests may be more predictive than some earlier work has indicated. Escalona (16) compared *Gesell Development Schedule* and *Cattell Infant Intelligence Scale* data with retests on Cattell and

Stanford-Binet. He suggested that infant tests of this type have greater value when integrated with other clinical procedures.

Wechsler (41) discussed the nature of mental development and in the light of his hypotheses brought forth the *Wechsler Intelligence Scale for Children* which, like his adult test, has both a verbal and a performance scale.

Caution against inadequate diagnosis of retarded mental development was sounded by many. Jastak (27) stated that an individual should be classified as feebleminded only if he fails to surpass the second and third percentile on *any* of several tests representing many functions. Arthur (4) recommended that those individuals whose test ratings have been depressed by special handicap be given training before a diagnosis is made.

Differences Among Children in Terms of Developmental Levels

Several studies have been made to discover differences among children of different stages of mental development—quantitative and qualitative. Baldwin (7) found that some Stanford-Binet items are not of the same difficulty for high and low IQ groups—the more realistic items being easier for those of lower IQ's. Cruickshank (14, 15) demonstrated that mentally retarded children solve problems in different and less adequate ways than do normal children of the same M A's. Brace (10) discovered only a slight relationship in motor learning of feebleminded girls as compared with normal girls.

Hunter and Bartlett (23) studied a group aged two to seven and found no child under three years and seven months able to solve the double alternation problem. From this age upwards correct responses can be extended beyond the length of the training series. Below five years, children do not verbalize the problem even if it has been mastered.

In a study of the development of space concepts, Ames and Learned (1) concluded that the child is usually able (a) to respond to a space word, then (b) to use it spontaneously, and finally (c) to use it to answer a question. Irwin (24, 26) presented evidence that the production of phonemic frequencies increases at a constant rate during the first one and one-half years of life and thereafter increases at an accelerating rate.

Effects of Physical Handicaps

Avery (6) found that aurally handicapped children are not inferior in intelligence, motor skills, or mechanical ability; but he also found that they do exhibit more emotional maladjustment. Hood (22) also found the deaf to be of normal intelligence. However, he concluded that more of those born deaf are of retarded intelligence than is true of those who are adventitiously deaf. Intelligence increases with attendance at a school for the deaf.

According to Knehr and Sobol (30) there was no significant deviation

from the average in intelligence at six years of age of those who had been prematurely born. Asher and Roberts (5), in a study of 4800 school children, found no difference in mean birth weight between the 20 percent of highest intelligence and the remainder. That whooping cough in early infancy may lead to severe intellectual deterioration was shown by Levy and Perry (31). Meyers (32) indicated that poliomyelitis, especially when contracted at an early age, tends to interfere with mental development. Among the cerebral palsied, Burgemeister and Blum (11) reported that the whole range of intelligence is represented, although there is a disproportionate number of mental defectives among those individuals showing rigidity.

Effects of Culture

Considerable research was reported on the effects of culture upon special abilities and upon the IQ. Irwin (25) found negligible effect of the presence of sibs in the family on sound development in infants; but Kalhorn (29) discovered that there are significant differences in performance of sibs on Stanford-Binet items. Older sibs tended to excel on rather abstract items, but younger ones succeeded on a larger number of items and, therefore, tended to have higher IQ's.

As to word fluency, Moore (33) compared the speech content of orphanage and nonorphanage children in an age range of 32 to 64 months. With chronological age and mental age constant, differences were found in favor of the nonorphanage children. Gewirtz (18) reported that the word fluency of preschool children whose parents were mostly in the professions had higher relationship with chronological age than with mental age.

Jessner (28) displayed case studies to illustrate that permissiveness in the treatment of children is favorable to mental maturity.

Baldwin (8) accounted for part of the variability in Standford-Binet IQ in children, ages three and one-half to 15, as being due to inaccurate adjustments at the younger and older age levels. Bayley (9), studying individual curves, found that a child's intelligence is more stable from test to test when described in standard scores than would appear from IQ's, and that the course of intellectual growth in each child is unique. Tests and periodic retests of 252 children from 21 months to 18 years by Honzik, MacFarlane, and Allen (21) indicated that IQ constancy is markedly dependent upon age. Changes of 15 points or more in IQ occurred in 60 percent of the cases, some changes being very large. The direction of change tended toward the family level.

Skeels and Harms (37) presented an investigation which showed that children whose mothers had low IQ's and whose fathers were of low occupational status, or both, and who were committed to an orphanage at less than six months of age and adopted by two years, attained mental levels equal to or exceeding that of the generality. Moreover, superior

intelligence appeared at a somewhat greater frequency than would be expected from a random sample. Skodak and Skeels (38), in a follow-up of 100 children from inferior backgrounds who were placed in adoptive homes, found not only that the intellectual level was consistently higher than what would have been expected from the parentage, but also that it was higher than that of own children in the socio-economic level in which they were reared. These studies which almost imply an advantage in being born in inferior circumstances will undoubtedly continue to encounter resistance in the emotions if not in the minds of many. Perhaps a clue to the answer may be found in Spitz's (39) experience. He reported that among 91 foundling-home children having no mother contact, 37 died during the first two years, and "with one or two exceptions those who survived behaved in the manner of agitated or apathetic idiots." Spitz's report was not without inaccuracies. Unquestionably it would be helpful to know whether or not the foundling homes studied by Spitz were typical. In all of these studies, obviously, the cause of low IQ's in parents should be known. Notwithstanding the extreme nature of the above report of Spitz, if the general hypothesis of the necessity of mother contact for normal mental development be true, it may, indeed, suggest an explanation for such findings as those reported by Skodak and Skeels. Those persons who adopt children may give them more affection and attention than do average parents, which may produce in turn the results indicated. Sawyer (36) reported a case of a child born to a mongoloid mother with an IQ of 25. This child was adopted at the age of two years. At age 11 he had an IQ well above average and had earned high marks thru the fifth grade of the elementary school.

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CHAPTER II

Mental Development During the Preadolescent and Adolescent Periods

GORDON HENDRICKSON

Summaries and General Treatments

SEGEL (57) prepared a well-organized monograph on the development of intellectual abilities in the adolescent period. He based his discussion on a wide variety of sources as well as on some new data. Other surveys of the research literature may be found in the revised *Encyclopedia of Educational Research* (42), and in articles by Jones and Bayley (33), and Thorndike (68). Textbooks on child or adolescent psychology by Averill (3), Breckenridge and Vincent (10), Cole (14), Cole and Morgan (15), Hurlock (30), and Olson (46) included sections on mental development. Olson drew many inferences for school practice from the research literature of the period.

Anderson (2) proposed a classification for literature pertinent to child development. Gesell and Ilg (25) combined their earlier works on infant and child development, stressing characteristics of successive age levels up to age 10. Jenkins, Shacter, and Bauer (31) prepared a popular treatment of the characteristics of children at each age from five to 11, and Schnell (55) wrote a digest on psychological characteristics of youth at four age levels from 10 to 21. In a pamphlet addressed to adolescents, Bouthilet and Bryne (9) discussed the factors in general intelligence and provided a helpful orientation for prospective test-takers.

The Organization of Intellectual Powers

Theoretical discussions as well as research on the organization of intellect have revolved around the problems of traits or factors. Burt (12) argued that the evidence points to a hierarchy of a general factor and a small number of broad group factors, subdivided into narrower group factors; i.e., to factors arranged by levels. To the primary group abilities recognized by Thurstone, Burt (11) would add a general factor. Anastasi (1) regarded traits as results of learning and, due to the greater cultural standardization of intellectual activities, considered traits as more consistent and easier to identify in the intellectual aspects of behavior than in the emotional aspects.

New tests produced in this period were chiefly analytical in character and generally yielded several scores. Notable are the *SRA Primary Mental Abilities* tests *(PMA)* by the Thurstones (69, 70), appropriate for subjects

from the junior high school thru the college level, and a set of seven differential aptitude tests by Bennett, Seashore, and Wesman (5).

Adolescent Intellectual Abilities

A number of studies attempted to isolate specific adolescent intellectual traits or dealt with their relationships. Johnson (32) studied problem-solving abilities in arithmetic at the eighth-grade level. Of the *PMA* tests, the vocabulary test gave the highest correlation with arithmetic problem tests. The flow of words in writing was studied by Taylor (66). Taylor analyzed fluency for high-school seniors into two factors: word fluency, i.e., facility in producing single, isolated words; and ideational fluency, facility in expressing ideas by means of words and their meanings. Murray (44) employed a multiple correlation procedure to analyze the geometric ability of high-school boys. He found spatial ability, as measured by the *Minnesota Paper Form Board*, and reasoning, as measured by the *PMA* tests, contributed less to success in geometry than numerical or verbal ability, as measured by the *Modified Alpha Examination*.

Fattu and Fox (24) found the ability of ninth-grade pupils to interpret data to be closely associated with factors which make up typical group measures of intelligence and achievement.

A unique approach to traits is found in two French studies by Michaud (38, 39). He was concerned with the interpretation which pupils give to geometric figures, and asked children aged nine to 14 to interpret the thickness of squares drawn on a blackboard or on paper. He found the percentage of realistic responses to diminish, and the percentage of rational responses to increase with age. Realistic responses, wherein subjects aged 10 to 15 were asked what would happen if a triangle which they imagined drawn on the ground were superimposed upon another imagined triangle, were also more characteristic of younger children in the second study.

Factor Analysis Studies

The most frequent procedure in attacking the problem of intellectual organization continued to be that of factor analysis. This procedure has been used to study changes with age, the relative importance of various factors for prediction, and other issues. In a group of studies, Swineford (62, 63, 65) reported the results of test batteries administered to pupils in Grades V to X and repeated at various intervals. Six tests were given to pupils in Grades VII or VIII and repeated when the pupils were in Grade IX. After one or two years factor analysis revealed no material change in the factor composition of the tests. The general factor apparently increased both in its absolute and in its relative contribution to the total test variance. For a group of pupils who took nine tests in the sixth grade and again in the ninth grade, three bi-factors persisted as entities but

grew at different rates; the general factor most, the verbal factor to some degree, the spatial factor not at all. The means for the general factor increased repeatedly and steadily with school grade level from Grade V to X. The means for the verbal factor increased gradually and irregularly. Retarded pupils were markedly inferior in the general factor, less so in the verbal factor, and equivalent to the normal group in the spatial factor. According to Swineford the general factor is the only one which predicted school marks with any consistency. Another report by Swineford (64) dealt with a number factor revealed by data from 19 tests given to ninth-grade pupils. This factor may be related to the pupil's mental set in approaching a task, a set determined by his liking or dislike for numbers. Swineford also inferred from the data that girls are more affectively sensitive to numbers than boys.

Curtis (16) also presented data emphasizing the importance of a general factor. His data on nine- and 12-year-olds failed to support Garrett's hypothesis that "abstract or symbol intelligence changes in its organization as age increases from a fairly unified and general ability to a loosely organized group of abilities or factors." On the other hand, Segal (57) accepted Garrett's conclusion and presented new data to show that differentiation among traits is more pronounced for bright ninth-grade pupils than for dull ones. Diamond (21) used a factor analysis procedure which he believed showed that the Wechsler-Bellevue subtests may serve as indicators of linguistic, clerical, and spatial aptitudes.

Development in Specific Traits

A number of investigators compared subjects at various ages by measures which were designed to reveal growth in particular traits. Webber and Hunnicutt (74) studied improvement in the ability to perceive change of color in painting with subjects from Grades I thru IX. Birch (6) found the Goodenough drawing test valuable in studying the processes of concept formation in a group of borderline or mentally defective children aged 10 to 16 years.

Three investigators were interested in moral traits. Turner (71) developed a scale of altruism and found no improvement from age nine to age 16. Beller (4) studied the attitudes toward honesty of boys aged nine, 12, and 15 years. On the basis of verbal problems, Dowd (22) studied moral reasoning in Catholic girls from Grades VIII to XII.

Hilden (27) reported a study of 100 children from birth, 30 of whom had taken several mental tests by the age of 16. The mean IQ of the subjects was 119 with a range of differences between repeated tests from seven to 64 points. On the average there was a slow and reliable rise in score not accounted for by practice effects. Hilden suggested that the highest IQ score prior to puberty might be more representative of mid-adolescent status than scores on the early test. Another retest study by Kvaraceus and Lanigan (36) reporting data on the *Iowa Every-Pupil Tests*

of Basic Skills administered at half-year intervals in the junior high school, indicated that individual performance at any one testing period should be interpreted with discretion; in some cases scores drop for a test period. A European study presented results from tests of subjects of various age levels. Vernon (72) found general intelligence increasing more rapidly and to a later age among boys who continue in school to the age of 17 and beyond, and among men in "intellectual" occupations. In general, Vernon concluded that abilities depend largely on the extent to which they are used.

Gains in Intelligence During College Years

Retests of students on the *American Council on Educational Psychological Examination* were reported from several colleges. In general, the investigators concluded that gains over and above practice effects do occur. Thorndike (67) found such gains occurring to the age of 20 and probably beyond. Projections of the growth curve for his data indicated either age 21 years, six months or 25 years, nine months as a point of zero gain, depending upon the mathematical treatment of the data. Shuey (59) found gains for college students.

Prediction of Academic Success

Studies on prediction of academic success in high school and college ranged from those which employed simple correlations of test scores and grades to multiple correlation and factor analysis studies. Shaw (58) used multiple correlation and Beta coefficients in treating data from the *PMA* tests and 13 measures of achievement for 591 high-school students. He found verbal-meaning to be highly related to every achievement measured, with reasoning in second place but not closely so. Little power to predict achievement was found for number, word fluency, space, and memory scores. A study evaluating several tests for prediction of high-school achievement was reported by Bolton (7).

At the college level Remmers, Elliott, and Gage (48) found certain tests developed at Purdue *(Placement Test in English, Mathematics Training Test, Physical Science Test)* more predictive of grade point averages of freshmen than scores on the *American Council on Education Psychological Examination*. Lanigan (37) found that the *ACE* differentiated better between high-achieving and low-achieving college students than the Otis test or the *Minnesota Speed of Reading Tests*. At the University of Wisconsin, Milligan, Lins, and Little (40) also found the *ACE* especially useful for identifying students at the upper and lower ends of the distribution of intelligence. They reported the *ACE* helpful in predicting achievement for nonhigh-school graduates admitted to the university.

Borg (8) reported low positive correlations between the *ACE* and success in a college of arts and crafts.

Investigators using the *ACE* repeatedly on the same group were warned by Muntyan (43) that the norms for a first testing cannot be justifiably used in interpreting the results of a retest.

Miscellaneous Relationships of Intellectual Abilities

Kendall (34) reported that there was no significant relationship of scores on a memory-for-design test with retardation in reading for a group of children aged six to 16. Hobson (29) gave *PMA* tests in Grades VIII and IX. Significant sex differences were found. Boys were superior in spatial orientation, and girls excelled in word fluency, inductive reasoning, and visual memory. Wheeler and Wheeler (75) inferred from correlations between *ACE* and reading test scores of university freshmen that *ACE* performance is highly influenced by reading skill. A Dutch version of the *National Intelligence Test* was used by de Groot (20) to study the effects of war upon the intelligence of youth. His 13- and 14-year-old subjects averaged four IQ points lower than similar subjects tested in prewar years.

Intellect in Relation to Social Factors

Davis and Havighurst (19) prepared a general report on cultural factors claimed to produce differential test results in various socio-economic groups. These writers continued to present evidence on this problem as well as general discussions of their theoretical position (18). Schulman and Havighurst (56) found a correlation of .46 between vocabulary size and socio-economic status for children in Grades IX and X in a midwestern community. Durea (23) presented some evidence indicating that the mental retardation of delinquent boys aged 11 to 18 may be a reflection of the sub-par socio-economic conditions from which the delinquents come.

Intellectual Growth of Feeble-minded Children

By the publication of claims that feeble-minded children had been made normal thru education, Schmidt (52, 53) precipitated one of the most violent psychological controversies of recent years. Popular articles on Schmidt's work by Stern (61) and Clark (13) challenged long-settled beliefs concerning the improvement of the mentally deficient. Schmidt reported an eight-year study of 322 school children, aged 12 to 14, ranging in IQ from 27 to 69, including experimental and control groups. For three years the experimental subjects were taught in a school environment planned to decrease nervous tensions, to remove emotional blocks, to further social interaction, and to develop self-confidence and a sense of personal worth. Regular school subjects plus hand work were taught at a slower rate than normal to a control group. A five-year follow-up permitted study of out-of-school or later school adjustment of

these individuals. The results for the experimental group included (a) gains in social adjustment and maturity and in Bernreuter scores, (b) the completion of a four-year high-school course by 27 percent of the group, (c) a good employment record for children out of school, and (d) an increase in IQ from an initial mean of 52.1 to 71.6 after three years of training and to 89.3 after the five-year follow-up.

Kirk (35) reviewed Schmidt's study in the light of an investigation of pertinent data in board of education records in Chicago, where Schmidt was a teacher. Kirk raised questions concerning: (a) the correspondence of the initial IQ distributions for the subjects with the statistics for Chicago special classes as a whole; (b) the appropriateness of the Bernreuter test for pupils of the mental status of the subjects; (c) certain statistical anomalies in the presentation of the data; and (d) the professional status of Schmidt at the time of the study. Schmidt (54) replied in general terms stressing scientific method, similar results reported by other investigators, and professional ethics. A survey by Nolan (45) revealed considerable doubt of the validity of the results on the part of several well-known psychologists.

Other evidence on intellectual changes in mental defectives is conflicting. Rudolf (49) reported that on the Wechsler-Bellevue verbal scale and on the *Vineland Social Maturity Scale* 395 defectives showed more rises than declines on retests six months or more after initial tests. The inference was drawn that defectives should be given continued education after the age of 16. Guertin (26) reported on the mental growth curve of 25 institutionalized defectives whose IQ scores showed marked increase over a period of time in comparison with the IQ performance of 25 controls who failed to show improvement.

A report by Hill (28) on retests of 107 special-class children in Des Moines showed occasional significant changes in IQ, possibly due to the social environment, but there were no consistent gains such as those reported by Schmidt. Sloan and Harman (60) studied 1446 institutionalized mental defectives, for whom the median chronological age at initial testing was 14.4, at final testing, 17.6; the corresponding median IQ's were 51.9 and 47.4. Cutts and Lane (17) reported that 57 defectives who had been hospitalized for seven years received lower scores on the Wechsler-Bellevue verbal scale than 57 defectives hospitalized for one year.

Two studies dealt with educational programs for adolescent special-class pupils. Mones (41) discussed 10 years of experience in Newark, New Jersey, where a specially adapted program at the junior-high-school level proved profitable to special-class children.

Chemical Regulators of Intellectual Growth

Glutamic acid has been claimed by several investigators to stimulate intellectual growth on the part of mental defectives. Waelsch (73) re-

viewed 23 references on this subject. Zimmerman, Burgemeister, and Putnam (77) reported on a series of clinical cases, ranging from infancy to adolescence, and concluded that glutamic acid accelerates mental functioning in human beings, chiefly in the first six months of treatment. A ceiling of improvement is apparently reached after one year of therapy. Zimmerman (76) suggested a definite dosage and claimed that the treatment had value for children in the 70 to 80 IQ range. Quinn and Durling (47) reported small gains (three to five IQ points) for institutionalized defectives treated with glutamic acid for six months. Rudolf (50, 51) investigated the value of thiamine treatment. Out of 90 defectives who had not improved for over a year, all of whom were treated with thiamine, 17 showed some increase in IQ, and 20 showed an increase in social age.

Unsettled Issues

Few issues in this field can be regarded as closed, but a list of a few unsolved problems in which there is current interest may be helpful. Several of the following research areas were suggested by Segel's review (57): (a) The existence or significance of a general factor in intellect; (b) Increase of differentiation among traits with age; (c) Relative variation of traits within the individual and within groups; (d) Stability of the mental growth of individuals; (e) Independence of time cycles for growth of various traits; (f) Existence of definite interest areas in early adolescence and their relationship to intelligence; and (g) Relationship of intellectual traits and level to socio-economic factors.

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CHAPTER III

Intellectual Changes During Maturity and Old Age

HERMAN D. BEHRENS and ROYAL F. NESTER

Introduction

Most of the research published since the last review of this topic in 1947 deals with (a) tests of adult intelligence, (b) factors affecting intellectual change, and (c) the intellectual changes which take place during maturity and old age. Many of the investigations relate specifically to changes in psychosis. The authors will follow the policy set in previous reviews of this topic by citing studies involving clinical cases only when they contribute to an understanding of the normal aging processes. Therefore, the amount of actual research in this field is limited. In many of the areas, the data are conflicting, which makes it extremely difficult to draw valid conclusions. For the most part the trend during the last three years was toward the study of physical and intellectual changes of normal people during old age. Many of the investigators seem to have analyzed their data very critically in an effort to determine the effect of the part scores of intelligence tests on the total score. Furthermore, they have studied the qualitative aspect of intelligence with special reference to the factors affecting intelligence, such as years of schooling, occupation, and the socio-economic background of the test group.

Tests of Adult Intelligence

The two most widely used scales for measuring adult intelligence were the *Wechsler-Bellevue Adult Intelligence Scale* and the *Shipley-Hartford Retreat Scale*. Both of these instruments were criticized as measures of mental status. Garfield (12) used the scores of 126 men who tested below a mental age of 11 on the Shipley-Hartford scale and compared them with scores made by the same men on the Wechsler-Bellevue scale. He found the scores of the Shipley-Hartford scale comparatively lower than the scores obtained by the same group on the Wechsler-Bellevue scale. Garfield concluded that the mental age secured from the Shipley-Hartford scale cannot be interpreted as a valid mental age, particularly for individuals in the lower half of the intelligence distribution. Garfield and Fey (13) made a comparison of the Wechsler-Bellevue and the Shipley-Hartford scales as measures of mental impairment. They found a correlation of .13 between the *Wechsler-Bellevue Indices of Impairment* corrected for age and the *Shipley-Hartford Conceptual Quotient*. Their study also showed a decided drop in score on the Shipley-Hartford scale with increase

in age, whereas the opposite was true with the corrected Wechsler-Bellevue index. Kass (17) reported that *Wechsler's Mental Deterioration Index* (the ratio of tests that do not hold up with age to those that do) failed to detect and confirm the presence of organic conditions resulting largely from traumatic brain injury. Hunt (15) analyzed the mean and standard deviation of subtest scores for different age groups from Wechsler's data and concluded that only two of the "Hold" tests, Information and Comprehension, functioned well with increasing age groups. Block Design and Digit Symbol are the only two "Don't Hold" tests that showed gradual and consistent age decline with respect to Information and Comprehension. Boehm (2) concluded from a study of 22 familial defectives, aged 15 to 61, that Wechsler's Deterioration Index could not be trusted to distinguish mental loss from mental deficiency. In an attempt to determine the validity of some abbreviated scales, Kushner (18) tested 131 subjects at age 14 years with the *Arith-Re Intelligence Test* and retested at age 34 with the *Otis Higher Examination.* Items in the latter test were classified into content subtests. No significant differences were found among the correlations between scores on these subtests at age 34 and Arith-Re scores at age 14. Schlosser and Kantor (22) analyzed 163 Wechsler-Bellevue tests and found that they revealed no statistically significant difference between the deterioration ratio of schizophrenic groups as contrasted with a psychoneurotic group.

Mental Decline

The adequacy of each of several methods used to measure mental decline has been supported and refuted by experimental evidence. Some of the more prevalent areas investigated were vocabulary, reasoning, memory, and manipulation. Raven (21) used the *Progressive Matrices Test* and the *Mill-Hill Vocabulary Scale* to trace the normal changes as age advances. His data indicated that the capacity to form comparisons and reason by analogy declined slowly after 25 and that the average person's ability to recall information declined slightly after 50. *Babcock Test* records of 404 psychiatric patients were analyzed by Rabin (20). He noted an obvious decrease in efficiency with age regardless of diagnosis and a slight tendency for vocabulary increase. Fox (10) used the *English Recognition Vocabulary Test* of Seashore and Erickson with two age groups of 70 to 79 years and 40 to 49 years respectively, and found no significant differences either in the number or quality of definitions between the two age groups. Using the complete Wechsler-Bellevue, Lewinski (19) examined 1000 white males ranging in age from 17 to 62 years and in school training from no schooling to two years of college. He found vocabulary to be a relatively stable function in adulthood. The correlation between age and vocabulary scores was .17. Brown (5), however, found that real differences in learning remain when intelligence

level is statistically controlled and that quality of vocabulary decreases with age. Chesrow and others (6) found no correlation between physical conditions and the Wechsler-Bellevue or Rorschach findings and indifferent correlation between Rorschach results and Wechsler-Bellevue deterioration scores. The Rorschach revealed delayed responses, reduced number of responses, stereotyped thinking, constriction in intellectual and emotional spheres, and impotence. Studying the normal changes in the mental abilities of adults, Foulds and Raven (9) administered the *Progressive Matrices Test* and the *Mill-Hill Vocabulary Scale* to 1967 adults. Rate of decline on the Matrices Test is uniform from age 25 on but the vocabulary scores show little decline to age 60. The ability to form comparisons and reason by analogy reaches its maximum at about age 14, remains constant to about age 25, declines gradually to age 60 and then more rapidly to age 80.

In a study made of Terman's group of 1000 gifted children, Thorndike (25) found that they had regressed some 40 or 45 percent of the way toward the population mean over a 20-year period. This amount of regression is somewhat greater than that presented by Terman (24). Copple (7) derived a set of Beta weights for the purpose of determining a pattern of senescence. He used for his subjects 1403 white males between the ages of 20 and 69. Of this group 531 were normals and 872 were neurotics. When the Senescent Decline formula was applied, the results showed that the mean drops steadily and fairly regularly from each age group to the next older. The data also indicated that the "pattern of senescence is so marked that it stands out clearly in both normals and neurotics and is relatively uninfluenced by psychiatric status." Brown and Ghiselli (4) found that the abilities of older workers in industry are comparable to those of younger ones in speed tasks which involve neither precision nor complex mental processes and in tasks which involve familiar operations and materials. However, inferiority of the older groups was manifest in tasks which involved the abstract and the complex.

Factors Related to Test Scores

An earlier issue of this publication devoted some attention to studies dealing with certain factors that affect intelligence test scores. More recently, Fox and Birren (11) administered the vocabulary subtest of the Wechsler-Bellevue test and a 50-word multiple-choice list taken from the Seashore-Erickson test of 216 residents of a home for aged indigents in an effort to determine the factors affecting vocabulary size in later maturity. They found an indifferent relationship between vocabulary size and either length of institutionalization or age, and between vocabulary size and auditory and visual defects. Guetzkow and Brozek (14) assembled a battery of six tests which measured performance in perception of spatial relations, word fluency, perceptual speed, memory, number facility, and inductive reasoning. They found only slight disturbance of the intellective

functions when these tests were administered to adult subjects undergoing nutritional stresses. One of the most valid studies of the learning ability, as it relates to age, education, and intelligence, was made by Schneider (23). Data were collected on 3134 subjects. He found a correlation of .10 between *General Classification Test* scores and age, of .09 between schooling and age, of .17 between success in learning and age, and of .53 between age and occupational experience. The results showed that age had little effect on the *General Classification Test* scores. Huston (16) found that electric shock treatment did not produce any significant impairment of mental efficiency on patients suffering from depression, hypomania, or psychoneurosis. Allen (1) presented two brief accounts of personality disorders and found that it was impossible to determine whether the stupor reactions were of functional or organic origin. Boice and others (3) presented evidence to show that there was no deterioration in color efficiency from age 20 to 59. However, 25 percent of a small sample of 21 subjects aged 60 and over were color-blind. Also, to show physical deterioration with age, Fisher and Birren (8) using a Smedley hand dynamometer found that muscular strength shows an increase to the late 20's and a decline at an increasing rate from that age upward.

Conclusions

Attempts to measure intellectual decline during maturity and old age are of relatively recent origin. The number of studies reported in the period covered by this chapter pertaining to the specific problem was small and the research was not without its limitations. A number of the studies showed that individual scores on mental tests began to decline after the third decade. The rate and amount of decline varied with the test given and the individual or group of individuals to whom the test was administered.

The data gathered thus far do not tell the final story. The instruments were not sufficiently refined to measure deterioration. Moreover, the instruments used were not constructed for measuring deterioration of the aged, nor were they standardized on the aged. The exact meaning of normal deterioration and abnormal deterioration has not been defined, nor has the exact relationship between physical and mental decline been established.

The outcomes of the studies in the field of senescent decline must therefore be interpreted with considerable caution. In some studies the investigators have given the same tests to both young and old people. In certain instances senescent individuals made lower scores in certain types of tasks within a test. It is quite possible that factors other than mental decline caused the decrease in scores. Furthermore, some of the measurements have been made on aged people in institutions. The assumption that the accomplishment of this group represents the typical accomplishment of the general population may be highly questionable.

The examination of the research on intellectual changes during maturity and old age reported during the period covered by this chapter leads to the conclusion that there is need for (a) much more careful planning of research patterns in this area, (b) more critical and conservative interpretation of the results, and (c) the validation of new instruments for the measurement of mental decline.

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CHAPTER IV

Motor Development and Decline

NANCY BAYLEY and ANNA ESPENSCHADE

CURRENTLY, there is an increasing professional and general interest in the changes which take place in later life. It has, therefore, seemed pertinent to include in this chapter references to researches which are concerned with age changes in motor abilities thruout the entire life span. Motor abilities cover a wide range from large-muscle coordinations, strength and balance or postural control, to fine manual coordinations involving speed and dexterity; from simple reactions to complex, highly-specialized patterns of reaction, including vocational and athletic skills. Numerous studies concerned with specific manual skills of young adults where there is no consideration of changes with age, and which are primarily concerned with learning, even tho the tasks involved are motor in nature, have been excluded from this survey. However, a few studies on laterality which give information on developmental changes have been included.

Altho the age range has been extended and the field broadened, the total number of investigations reported in this area of motor performance has declined during the past three years below that of the preceding three-year period. In fact, the number of references cited in the successive chapters on motor development in the REVIEWS on Growth and Development, has shown a steady decline since the first one appeared in 1941.

Infancy and Early Childhood

For this age range, very little new research on motor coordinations, as such, has been reported in this country. However, several studies of age changes in postural orientations and in the development of handedness were published during the period covered by this review. Ames (1) made cinemanalyses of writing and block building behavior of 179 cases aged 36 weeks to 10 years. She found definite age sequences of posture patterns and hand positions for these activities. The patterns appeared to be related to the general degree of neuromotor maturity.

Gesell and Ames (17), and Ames (1) made a cinemanalysis of the Yale developmental data. These data revealed a tendency for alternating preferences in laterality during growth and also several successive periods of bilaterality alternating with unilateral reaching and manipulation. Hildreth (20) in a study of nursery-school children reported early changes in handedness. Hildreth emphasized the gradual settling down to a preference of one or the other hand and the gradual increase of right-handedness with age. In a series of five articles (21, 22, 23, 24, 25) Hildreth made an extensive review of the whole question of laterality and discussed such

things as probable etiology, age changes, the reasons for clumsiness in left-handed performances, the great extent of bimanual activity in which the nonpreferred hand may be very skilful for specific functions, and methods of training hand dominance. She presented an age curve of the percentage of right-handedness, which shows a rapid increase to three or four years followed by a gradual increase to seven or eight years. A result of possible relevance here was reported by Mintz (32) who found a relatively high percentage of left-handedness in feeble-minded boys aged eight to 17 years.

Age Changes, Six to 18 Years

Data from L. Dewey Anderson's previously unpublished studies of motor performance in 3000 Cleveland children have recently been presented graphically by John E. Anderson (3). These motor performances included (a) measures of grip strength, (b) an aiming test, (c) baseball throw for distance, (d) basket-ball rapid pass, and (e) broad jump for boys and girls six to 18 years of age. The girls were superior to the boys in only one test. They excelled in aiming, which is a matter of fine coordination, not of strength or speed. The boys' superiority in the other tests became more marked in adolescence.

In a study of flexibility (range of movement in joints) in girls six to 18 years of age, Hupprich and Sigerseth (26) reported that flexibility of the shoulder, knee, and hip joints declined gradually from six to 18 years. In nine measures, including trunk, head, elbow, and ankle joint measures, an increase occurred from six to 12 followed by a decline. In certain of these trunk, wrist, and leg measures, however, 18-year-olds were found to be more flexible than six-year-olds. Low intercorrelations between measures were found. The authors concluded that flexibility in girls was a function of specific factors.

The effects of physiological maturity on the motor achievements of boys have been studied by Nevers (33). McCloy's classification index (combining age, height, and weight) was correlated with strength, track events, and endurance measures for prepubescent, pubescent, and post-pubescent groups. Strength was found to be most closely related to physical size. In some track events the prepubescent was superior to the pubescent performer.

Jones (28) made a detailed analysis of static dynamometric strength in 176 boys and girls who were tested at six-month intervals from 11 to 18 years of age. Growth curves for boys and girls were approximately parallel up to 13 years, after which they diverged sharply as the girls neared their mature ability, while the boys continued rapidly to increase in strength. Differences in strength were found to be related to rates of physical maturing, and for boys to the degree of mesomorphy in build. Age curves of growth were different for grip, thrust, and pull, and the sex differences varied with the nature of the test.

Seashore (37) developed a reliable beam walking test and reported results on boys five to 18 years. According to his data little improvement was shown after 11 years. However, for a similar test, Heath (2) gave tables which showed continued improvement thru 14 years for both sexes, especially for boys.

In a reaction time experiment on high-school boys 14 to 17 years of age, a slight improvement of hand response with age was shown. When the response involved movement of the entire body, however, the 15-year-old group showed no improvement over the 14-year-olds. In this same response Atwell and Elbel (4) found no significant difference between high-school and college groups.

Several studies in progress, which are pertinent here, have been reported by the Children's Bureau, Federal Security Agency (39), and by the Motor Skills Research Exchange (2). These included such topics as rotary pursuit performance of children in grades five to eight (2), dynamic balance of adolescent boys, and physical performances of secondary-school boys classified by a grid technic (39). Bayley (2) reported repeated measurements on the same children from the age of four thru the age of nine on tests of manual dexterity and some large-muscle coordinations. No information was available as to when or where these studies might be published, but these two sources of information should prove useful to people who are doing research in the areas covered.

Changes in Performance After 18 Years

Altho the literature reveals a spreading interest in mental characteristics of later maturity, relatively little current investigation of changes in motor performances has been reported.

Fisher and Birren (14) studied grip strength of Navy personnel, men and women, and industrial workers. They reported an increase in strength up to the late 20's, followed by a decline which by 60 years amounted to a 16 percent drop from the maximum. Correlations with age, height, and weight were computed.

Welford (2) reported research in progress at the Psychological Laboratory of Cambridge, England, on the effect of aging on throwing at a target, on grid-position matching, on pursuit motor tracking, and on tracing performance. In another report (45) he stated that in simple sensory motor skills all older groups showed on the effector side little change in achievement, but showed some profound changes in method. On the receptor side, some striking changes appear to begin in the 30's.

It was evident that some kinds of motor abilities were more subject than others to the effects of aging. Some of the apparent inconsistencies between studies were in all probability due to differences in the samples studied. Skilled athletes might be very different, in this respect, from those with

average or poor motor coordinations. Here, again, the most conclusive answers could be drawn from series of retests of the same individuals.

Measurement

During this period there has been some activity in the development of tests of motor abilities. These additions to the supply of measuring instruments should be useful in gaining more adequate information concerning the nature of motor abilities and their age changes in both old and young.

Continued interest in the Oseretzky scale of motor proficiency tests was demonstrated by a number of publications. The tests are now readily available (6, 13, 38). Lassner (30) published an annotated bibliography of 44 references which contained some reports of these tests. Results on Italian children (16) and feeble-minded groups (6) have been published. A progress report on standardization of the battery for children three to nine years of age and also a report of a study on female mental defectives was made (39).

Clarke (7, 8) described a tensiometer and test procedure for measuring strength of muscles activating movements of the joints. Different test positions between 20 and 25 degrees apart were selected. The studies showed that a muscle exerted its greatest power when it functioned at its greatest tension, and that probably there was a position in which each muscle group functioned the best.

A motor fitness test for college men developed from factor analysis of an extensive battery was described by Cureton (11). Fourteen items were in this test; a short screening form was also presented.

Norms for performances of elementary-school boys and girls, Grades IV thru VIII, on the *Indiana Physical Fitness Test* have been published by Franklin and Lehsten (15). This test included such items as chins, push-ups, and vertical jump.

Norms for Wisconsin high-school boys in physical education activities such as push-up, pull-up, and potato race are now available (29). Swimming norms for high-school and for college men were reported by Hewitt (18, 19).

Van der Lugt prepared an American adaptation of her previously developed (European) test of manual ability for children aged six to 12 years (44), and also a test for adults (43) which utilized the same materials. According to these tests the most rapid development in manual coordinations occurred between the ages of six and nine years with little difference between the sexes. Van der Lugt made a number of comparisons between the test scores and other variables, primarily from her European material. Among these she reported no relation with handedness, mental ability (except in cases of mental deficiency), marked inferiority in performance of the nonpreferred hand, or motor patterns which appear to be related to personality traits. The tests should prove valuable in investigations of similar variables in this country.

Another test of manual ability was the *Small Parts Dexterity Test* of Crawford and Crawford (10) standardized on high-school students and adults.

Relation of Motor Abilities to Other Factors

Race and sex differences in physical performance have been noted by Jokl (27) on the basis of data collected in South Africa. He stated that physical efficiency might be regarded as a secondary sex characteristic. Bantu were found to have a superior performance capacity as compared with whites, and their superiority was relatively greater in the case of girls.

A study by Codwell (9) of the motor performance of American Negro boys classified according to degree of hybridity showed no reliable differences among groups.

Van Dalen (40, 41, 42) investigated motor abilities of adolescent boys and girls in relation to the frequency, duration, and types of play in which they participated. Time devoted to play was more highly related to CA and MA than to motor quotient or physical fitness index. However, these latter were significantly correlated with both frequency and duration of play.

In a study of motor learning of feeble-minded girls, Brace (5) found that IQ was more closely related to motor ability, strength, and athletic ability than was the case with girls in the same age range but with normal intelligence. Correlations of the order of .5 were obtained. However, motor learning scores were not significantly correlated with IQ.

Curtis (12) gave the *Purdue Peg Board Test* to 70 blind adults of normal intelligence. Tentative norms showed that the blind subjects were markedly handicapped in both functions tested but less so in "assembly" than in "insertion."

Twenty third-grade children exhibiting extreme levels of achievement in motor tests were selected for study by Rarick and McKee (35). Ten children ranking high were compared with 10 low ranking children in physical, mental, and social characteristics recorded in "life histories." The superior children were found to be older, taller, heavier, and stronger, were early walkers, were more active, and appeared to have had more opportunity for play than was true for the low ranking cases. These findings were in accord with those of other studies on adolescents including the current study of Jones (28).

Nature of Motor Abilities

Seashore and others (37) published a factorial analysis of arm-hand precision tests based on 100 college men. The measures selected were relatively uninfluenced by strength and speed, were free of the effects of muscular fatigue, and showed little practice effect. A single factor of steadiness could not account for the variance in the battery. Stationary

steadiness was not highly related to precision of movement. Spatial factors were found to be present.

A series of physical education tests for college women were factored by Phillips (34). This study appeared to raise more questions than it answered. However, the results indicated that certain test batteries did not measure for this age and sex what they purported to measure.

Physical ability tests and motor learning scores for high-school girls were factored by McCraw (31). The several types of motor learning proved to be unrelated to each other.

Indications for Future Research

A real need is indicated for a coordinated series of studies investigating age changes in the organization of both gross and fine motor abilities and their interrelationships. Further longitudinal studies of increments and decrements with age for different types of motor performances, and for different kinds of populations, should be planned. There is need, too, for information about the effects of attitudes and incentives on age changes and sex differences in motor ability scores.

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CHAPTER V

Personality and Social Development

GLENN M. BLAIR

THE problems involved in investigating personality development and social development are so closely related that it is difficult, if not impossible, to separate them. An individual's behavior in social situations is a direct measure of his personality development. Jerome S. Bruner (19) in a recent review of social psychology and the group processes referred to the "increasing smudging of the boundary between social psychology and the psychology of personality." In spite of the fact that studies of personality development and social development have been treated in separate chapters in previous reviews on this topic, they are presented in a single chapter in this issue.

During the past three years research workers showed considerable interest in the field covered by this chapter. This was a continuation of a trend which began some 10 or 15 years ago. Psychologists as a group have shown a growing concern with the problems of personality and social growth and with the factors affecting the individual's total adjustment to his social and physical world. If space permitted, several hundred specific investigations falling in the general area of this review could be cited. Since it is necessary to be highly selective, only a fraction of that number have been included and discussed here. The studies are grouped under the following headings: (a) effect of early infant experience on personality, (b) family relationships and personality development, (c) studies of prejudice, (d) culture and personality, (e) personality change with age, (f) personality development of handicapped individuals, (g) studies of social relationsips, (h) physical and biological determinants of personality, and (i) technics for evaluating personality and social development.

Effect of Early Infant Experience on Personality

Freudians have long held that the experiences of early infancy leave lasting marks on the individual's personality. They have been especially concerned with the effect of infantile suckling, excretory, and genital experience on adult personality. In general their conclusions have been based upon a theoretical position rather than upon research. Goldman (36) proposed to make an experimental attack upon such problems. Using the method of factor analysis she reported the existence of two types of individuals, oral pessimists and oral optimists. She promised to provide evidence in a later paper of the effect of length of breastfeeding upon the development of these personality types.

Orlansky (67) reported an excellent summary of existing objective

studies dealing with the effects of nursing experiences, mothering, sphincter training, restraint of motion, etc., on personality development. He concluded that there was no evidence that breast-fed babies were better adjusted in later life than bottle-fed babies, or that children who received early or late sphincter training were particularly different from other children. In general, the data he amassed do not seem to support the Freudian notion that certain specific infant experiences provide the overwhelming basis for adult personality. Instead he was led to believe that the total cultural context in which a specific practice was embedded plays a more decisive role. Support for this position was found in Benedict's (10) study of the effects of swaddling on Russian, Polish, and European Jewish children. She concluded that the child's character is not determined by the overt details of early infant care, but by the attitudes and motives communicated to the child by the mother in connection with the practices employed.

Family Relationships and Personality Development

An excellent example of research on parent-child relationships and personality development was found in the study by Baldwin (7) which was conducted at the Fels Research Institute. The specific purpose of the investigation was to explore the consequences of democracy in the home upon the personality development of 67 children who were approximately four years of age. These children were observed in free play situations in the nursery school. Their behavior was recorded on a rating scale by independent observers who also rated the extent to which the homes from which the children came were democratically or autocratically operated. Democracy in the home was found to produce children who were active, aggressive, fearless, planful, likely to be nursery-school leaders, more likely to be cruel than average, curious, and nonconforming. Children from authoritarian homes tended to be quiet, well-behaved, socially unaggressive, and restricted in curiosity, originality, and fancifulness. In a California investigation involving a developmental study of 500 nursery-school children over a three-year period, Koshuk (54) reported that children coming from homes where the parents disagree on methods of discipline are much more often problem cases than are children whose parents agree on methods of control.

Family influences having a relationship to delinquency were studied by Jenkins and Glickman (49). These investigators found three types of delinquent children, (a) an unsocialized aggressive group, (b) a socialized delinquent group, and (c) an emotionally disturbed delinquent group. The unsocialized aggressive boys predominantly came from homes where they had experienced parental rejection; the socialized delinquents were better accepted at home than the aggressive delinquents and came from larger families, but were reared under conditions of extremely lax discipline. The emotionally disturbed delinquent tended to be the

unfavored child in his family and to come from a smaller family than either of the other two groups. In another study of problem children, Sloman (91) analyzed the family backgrounds of 62 individuals who were referred to the Chicago Juvenile Court. All the cases in the particular group were "planned for" children, i.e., children who were originally wanted by their parents and whose births were definitely scheduled. The findings revealed that many of these children had been wanted in an effort to remedy marital difficulties. The largest number, however, were children of compulsive and perfectionistic type mothers who liked to plan everything and who were often disappointed when their children failed to meet their expectations as to sex or achievement. This study seemed to imply that whether a child was planned for or not was of little importance so far as the child's character and personality were concerned. The really crucial point was whether or not he was wanted and made to feel secure after he arrived.

Studies of the relationship of personality and character development to family organization and control have also been made by Brown and others (18) and by Sherman (88). Brown's study revealed correlations of above .40 between character development as measured by his scales and certain types of family relationships. Sherman did not find any very significant relationships for the group studied by him. He attributed this to evidence he obtained that the parents did not honestly and objectively answer the questionnaires submitted to them, but instead gave answers which placed them in the most favorable light possible.

Studies of Prejudice

Numerous investigations during this period have dealt with the social and psychological roots of prejudice. The most monumental of these have been sponsored by the American Jewish Committee and published in three volumes.

The first volume, written by Adorno and others (2), represented a large scale study of prejudiced and unprejudiced individuals, and revealed a close correlation between a number of deep-seated personality traits and prejudiced behavior. In the course of this research, scales for measuring anti-semitism, ethnocentricity, Fascistic tendencies, and politico-economic conservatism have been developed. The second volume, by Bettelheim and Janowitz (13), considered the connection between personality traits and prejudice as found among war veterans living in a large American city. The third volume (1) derived its data from case histories of a number of individuals who received psychotherapy. The specific conclusions from these three books were too numerous to report here, but provided the basis for the following summary statements: (a) people who professed religious affiliation were more prejudiced than those who did not; (b) that individuals who scored high on the conservatism test were more prejudiced than those who were more liberal; and (c) that individuals who accepted

parental attitudes were more prejudiced than those who did not do so.

Rosenblith (78) repeated the Allport-Kramer (4) study using as subjects students in nine colleges in South Dakota. In spite of the almost total absence of Negroes and Jews in the region, there was evidence of more prejudice toward these groups than was found by Allport and Kramer among students in New England where greater opportunity existed for contact with these minority groups. War veterans were also found to be more prejudiced than nonveterans.

Rokeach (76) found that prejudiced individuals showed more rigidity and inflexibility of thinking than nonprejudiced subjects even when dealing with such nonsocial problems as arithmetic. Campbell (21) obtained high correlations between dissatisfaction with personal economic circumstances and prejudice toward Jewish people. Other studies of factors related to prejudice have been made by Miller and Bugelski (66), Hayes (45, 46), Saenger and Schulman (81), Radke and Sutherland (73), Razran (74), Schonbar (82), Katz (51), Zeligs (107), and MacKenzie (64).

An experimental study by Lindzey (56) revealed that the scapegoat theory had serious limitations as a general explanation for prejudice. Zawadzki (106) in a theoretical article likewise criticized the scapegoat hypothesis on the grounds that it failed to explain why prejudices were directed toward some minority groups and not toward others. He indicated that the behavior of a minority group may be one of the factors in the total causation of the prejudice.

Bayton and Byoune (9) studied the racial prejudices of deep-south Negroes. They seemed to stereotype members of their own race in much the same manner as did whites. Their attitudes toward Germans, Japanese, and Jews were also very similar to those held by whites. In describing white Americans, however, such terms as pleasure-loving, grasping, deceitful, and cruel were frequently used, indicating that the stereotypes they held tended to be of somewhat unfavorable nature.

Studies of methods of reducing prejudice were made by Rosen (77) who found that the motion picture "Gentleman's Agreement" had the effect of reducing prejudice toward Jews, and by Axline (6) who presented evidence to show that play therapy could accomplish similar results. Williams (102) and Wirth (104) presented two important theoretical discussions and appraisals of methods of ameliorating prejudice.

Culture and Personality

Cultural anthropologists and social psychologists have shown continued interest in the relationship between cultural patterns and the personality development of individuals. Studies in this area fell into two major divisions, (a) those dealing with entire national or tribal cultures and (b) those concerned with subcultures within a broader general culture. In the first category such contributions as those of Gorer (37) and Mead (65) might be placed. Basing his conclusions on

the findings of Elmo Roper's *Fortune* surveys over a ten-year period and other general observations, Gorer concluded that there is a typical national American character. He developed the idea that this character arose from the rejection of the father figure of authority and the acceptance of the mother figure of discipline. Mead's book based upon materials drawn from seven Pacific cultures showed that great variations exist from culture to culture with respect to masculine and feminine traits. Personal characteristics attributable to general cultural practices of a given people were also found by Billig, Gillin, and Davidson (14) in Guatemala; by Sereno (86) in Puerto Rico; and by Wallace (99) who studied the Mohave Indians.

Examples of studies dealing with personality variations among subcultures and class groups of a given culture were reported by Hollingshead (48), Centers (25), and Loomis and Powell (58). Hollingshead's investigation dealt with adolescents who belonged to five social classes in Elmtown. Each class was found to have value systems and modes of behavior which distinguished it from the other classes. The treatment accorded adolescents in school by their teachers also varied according to the class to which the adolescent belonged. The Centers' study not only presented data on the psychological differences between social classes, but also developed a theory as to the origin of class consciousness. Loomis and Powell made a sociometric analysis of class status in rural Costa Rica.

Altho not specifically directed toward a study of social classes, the Kinsey investigation (52) showed differences to exist between individuals of the lower and middle classes with respect to sex attitudes and practices. Stendler (93) studied the extent to which elementary-school children were aware of the symbols of social class. Her findings indicated that first-grade children were almost entirely lacking in such awareness, but that by the time children reached the fourth grade they began to understand the meaning of class differences. Sixth- and eight-grade children were very much like adults with respect to their knowledge of social class symbols. Bossard and Sanger (16), using the data amassed in a case study, reported the consequences of social mobility on a young child. They noted that such changes as the following occurred in the child's behavior: (a) increased feelings of insecurity and uncertainty, (b) increased feelings of isolation, and (c) marked increase in verbalization.

During the past three-year period, two excellent anthologies by Haring (41) and Kluckhohn and Murray (53) dealing with research in the field of culture and personality appeared.

Personality Change with Age

Gray (38) studied the extent to which changes in Jung's psychological types took place with increase in age. His subjects consisted of 500 males and 500 females who ranged from 10 to 80 years of age. These individ-

uals were administered a questionnaire based upon extraversion-introversion inventories with additional questions added embodying further ideas expressed by Jung. The results showed that definite changes in personality accompany age increases. In general, he found that as people grow older, they tend to use their thinking slightly more than they do in their youth, to develop their sensation-function considerably more than they do in earlier ages.

Utilizing research studies as the basis for their conclusions, Harsh and Schrickel (43) traced the typical stages of personality development revealed by individuals from infancy to old age. Perhaps the most significant difference they noted between the adult and childhood personality was that the adult personality was more rigid than that of the child. Adults strove for a more limited set of goals than did adolescents, for example, and sought a continuously slower and more regular tempo of living.

Hartley, Rosenbaum, and Schwartz (44) investigated the relation of age to children's ethnic frames of reference. They found that children three and one-half to four and one-half years of age usually replied by giving their own name when asked the question, "What are you?" For the age group four and one-half to five and one-half this type of response was still given by some children, but many began at that age to use ethnic designations rather than personal ones. From the age five and one-half on, the child's conception of himself and others tended to be expressed almost entirely in ethnic terms. He considered himself or his neighbor as "American," "colored," "Jewish," "Catholic," "Italian," "Spanish," etc. Remmers and Weltman (75) found older children (Grades XI and XII) to be less like their parents in attitude patterns than younger children (Grades IX and X). This was a natural trend which would be expected in view of the strong drive for emancipation from the family found during adolescence.

The adjustment problems of the aged have continued to interest research workers in this field. A report by Pollak (71) pointed out a group of research problems in this area that demanded immediate attention and suggested technics for investigating them. A study by Fried and Stern (33) presented data on marital and other relationships found among 39 subjects in the 50 to 64 group and 36 subjects who were over 65 years of age.

Personality Development of Handicapped Individuals

Johnson (50), using sociometric technics, studied the social position of mentally handicapped children in regular school classes. The 39 children included in the investigation all had IQ's of 69 or below as determined by the 1937 Revision of the Stanford Binet, Form L. He found that the majority of the children were socially isolated, and that many of them were actively rejected by their classmates. The percentage

of mentally handicapped children suffering social maladjustment in regular classes was found to be statistically greater than that of typical groups which he used as controls. The study was carried out in two communities which had no special classes for mentally handicapped children. Cruickshank and Dolphin (26) investigated the emotional and social characteristics of crippled and noncrippled children using as their instrument of evaluation the *Raths Self-Portrait N Test.* They concluded that crippled children, on the average, differ little if any from noncrippled in so far as social and emotional adjustment are concerned. They did, however, suggest that crippling may have a deleterious effect upon the social adjustment of given children, depending upon the attitudes they hold toward their physical disability.

McAndrew (61), studying the personality structure of deaf and blind individuals, found the deaf and blind to be more rigid in the Lewinian sense than sensory normal individuals. Of the two groups, the deaf showed the more rigidity. He used the Rorschach test with the deaf and concluded that on the whole they reacted as normal children of a somewhat younger age.

Several studies of the personality characteristics of individuals suffering from various diseases were reported during this period. Wiener (101), using the *Minnesota Multiphasic Personality Inventory,* tested disabled war veterans suffering from arthritis, asthma, gunshot wounds, malaria, and duodenal ulcers, and compared their scores with those of nondisabled veterans. He found that numerous distinguishing characteristics existed between the disabled and the nondisabled. Benjamin, Coleman, and Hornbein (11) reported on a year's study of personality in pulmonary tuberculosis. One part of the investigation involved the administration of the Rorschach test to 16 subjects. This group as a whole showed a very high incidence of psychopathology as compared with the Rorschach records of normal groups. Phillips, Berman, and Hanson (70), using the *California Personality Test,* examined 101 Minneapolis children who had had poliomyelitis during the year prior to the study. They found no reliable difference between the group of children who were victims of polio and a control group of children.

Studies of Social Relationships

An increasing number of studies have dealt with problems and factors involved in interpersonal group relations. Of these, a large number have investigated the dynamics of friendship. Lundberg and Beazley (59) asked the entire population of a college the following question: "If, after leaving college, you could keep in touch with only three students now in college, which three would you choose?" The results indicated that common domicile was by far the most significant factor entering into the choices. Following this in order were college class, major scholastic interest, and socio-economic status. Scholastic standing and aptitude

showed little or no association with the preferences. In another study, Lundberg, Hertzler, and Dickson (60) found that persons disliked tend to be chosen from much the same groups as those liked. Propinquity thus appeared to be a dominant factor in both likes and dislikes. The role of propinquity in the formation of friendships was also clearly shown in the studies of Faunce and Beegle (29) and Austin and Thompson (5). Grossman and Wrighter (39) studied the relationship between selection-rejection and intelligence, social status, and personality among sixth-grade children. They found that intelligence was related to selection of friends up to a certain point, that of normal intelligence, but beyond that point no relationship existed. Social status was found to be related to popularity, but the association ceased for levels above the middle class. The more popular children were found to be better adjusted than the less popular as measured by the *California Personality Test.*

Bonney (15) made an intensive study of five very popular and five very unpopular children who had been identified by means of sociometric tests. He found that popular children differ significantly from the unpopular children in conformity and group identification, emotional stability and control, social aggressiveness, adaptability and tolerance, dependability, social service motivation, and several other traits. Thompson and Horrocks (96), studying the degree of friendship fluctuation for children in Grades VI to XII, found a trend toward greater stability in the friendships with increasing chronological age. Hare and Hare (40) found that the number of friends possessed by a family increases with length of stay in the community and varies with the presence or absence of children in the home. A negative correlation existed between number of friends and amount of expenditure for recreation outside the home.

Gibb (34) presented a theoretical discussion of the principles of leadership and gave data to support his position. He concluded that leadership is not a quality which an individual possesses, but is rather a function of the interaction of the individual's personality and a specific social situation. Wherry and Fryer (100) designed a study to determine if "buddy," "peer," or "co-worker" ratings would provide effective criteria of leadership. They found that buddies and peers were better raters of potential leaders than officers and classroom teachers.

Rosenthal and Cofer (79) studied the effect on group performance of indifference and nonparticipatory behavior on the part of one member of a given group. They found that such behavior of one member tended to shift the attitude of the whole group in the direction of disbelief in the attainability of the group goal. Preston and Heintz (72) presented experimental evidence to show that participatory leadership is superior to supervisory leadership in producing changes in group judgment. Other important contributions in the area of group dynamics were Lippitt's (57) investigation of group skills, Benne and Muntyan's (12) anthology of readings on group development, Lewin's (55) *Resolving Social Conflicts,* and Bales' (8) method for the study of small groups.

Physical and Biological Determinants of Personality

The relationship of biological and constitutional factors to personality manifestations continued to engage the energies of research workers. In general the correlations tended to be relatively low, but were often statistically significant. Sheldon (87), in a new study of body build and personality, investigated 200 delinquent young men who were residents of a Boston rehabilitation home. He found delinquents on the whole to be decidedly more mesomorphic than a control group of college males. The delinquents were also found to be below average in what Sheldon terms the T component, a measure of aesthetic quality of the physical structure. Seltzer, Wells, and McTernan (85) analyzed the temperaments of 51 males whose body types were predominantly ectomorphic. They found a strong and statistically significant relationship between ectomorphy and the psychotype known as cerebrotonia. This research appeared to confirm some of the earlier findings of Sheldon.

In a monumental study, Franklin, Schiele, Brozek, and Keys (32) investigated the effects of semistarvation on human behavior. Thirty-six young men were included in the experiment and placed on the inadequate diet for a six months' period. The behavioral changes produced were profound. As a result of the treatment, the men became depressed, irritable, nervous, emotionally unstable, socially withdrawn, uninterested in sex, and preoccupied with thoughts of food.

Franklin, Feldman, and Odbert (31) discovered significant relationships to exist between bodily movements while dancing and certain personality traits. Seltzer (84) noted that hair color, eye color, and cephalic index were associated to some extent with personality traits. The trend was for individuals with darker shades of hair and eye color to exhibit traits indicative of lesser integration, lesser stability, and greater sensitivity. Rounder-headed individuals were found to be more stable than those with less round heads. Brower (17) obtained substantial correlations between several Rorschach categories and such physical variables as pulse rate and diastolic blood pressure. McCurdy (62) found a significant relationship to exist between basal metabolism and academic performance. Hoagland (47) presented evidence which seemed to indicate that certain chemical conditions in the body are involved in the psychoses. Five additional studies which showed relationships to exist between constitutional factors and personality were reported by Kluckhohn and Murray (53).

Technics for Evaluating Personality and Social Development

Projective technics for the study of personality continued to be developed in great numbers during the period under review. In most cases the tests were of an intriguing nature and showed considerable

promise of usefulness, but the problems of validity and interpretation still plagued them to a great extent. Drawing of the human figure, which was used originally by Goodenough as a test of intelligence, was utilized in diagnosing personality. Machover (63) wrote an entire book on the possibilities of this method, and Buck (20) included the drawing of a person in his H-T-P technic. Studies (3, 80) of the reliability and validity of the draw-a-man-and-a-woman technic also appeared.

A new projective instrument that has caused considerable interest is the Szondi test (27). This test included six sets of photographs which are presented to the subject one set at a time. Each set contained a picture of a homosexual, a sadist, an epileptic, an hysteric, a catatonic schizophrenic, a paranoid schizophrenic, a manic-depressive depressive, and a manic-depressive manic. The subject was told to choose the two pictures best liked and the two least liked in each set, and finally, the four best liked and the four least liked in the whole group. The types of photographs selected and rejected were supposed to give insight into the subject's personality structure.

Handwriting received increased attention as a projective device for analysis of personality. Wolff (105) and Sonnemann (92) each produced a book on the subject which incorporated the results of some research. Investigations by Secord (83), and Pascal and Suttell (68), cast considerable doubt as to the efficacy of this type of method, but a study by Castelnuovo-Tedesco (23) seemed to corroborate some of the claims of the graphologists.

Other interesting projective devices which have been developed included a test of masculinity-femininity (30), a bas-relief test for the blind (42), the "three impossibilities test" (28), the "institution questionnaire" (89), and the *Make-a-Picture-Story Test* (90). Studies of such older projective technics as finger and easel painting (69, 103) and the *Sentence Completion Test* (94) continued to be made. Carter (22) described a method for investigating affective processes which combined a projective technic with the use of the psychogalvanic response.

A test of altruism was devised by Turner (97), and numerous instruments for evaluating the prejudiced personality were prepared by Adorno and others (2). Van Der Merwe and Theron (98) found the Goetz finger plethysmograph a useful device for measuring emotional stability, and Gladstone (35) developed a group palmar sweating test which also possesses some validity in evaluating certain states of emotion. Cattell and Luborsky (24) described a new clinical method for determining personality and symptom structure known as the P-technic which involves the factor analysis of data secured from repeated testing of the individual. Excellent reviews of research on personality tests were made by Symonds and Hessel (94).

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CHAPTER VI

Physical Growth and Physiological Aspects of Development

KAI JENSEN

Introduction

RESEARCH workers representing practically all of the fields of the sciences appear to have been studying the problems of human physical growth and physiological development during the period covered by this volume. They have employed methods ranging from the use of radioactive isotopes to questionnaires and ranging from controlled experimentation of excellent design to anecdotal records. The common goal is greater understanding of the factors influencing growth and development with the ultimate objective of better prediction and control.

This concerted and diversified attack upon the problems involved is producing a vast literature. In the field of the metabolic functions of the endocrine glands alone approximately 600 pertinent articles were published from July 1948 to June 1949 (158). Obviously a review such as this cannot do more than present a few representative developments which may be of interest to educators.

The physical and psychological growth of children thru the school years was treated effectively in a representative general text prepared by Breckenridge and Vincent (20). In this carefully integrated analysis of human development several chapters were devoted to physiological and neuropsychological functioning and the environmental impact upon the biogenetic endowment. It also included a very complete and excellent bibliography. Elsewhere splendid reviews of the literature dealing with specialized problems of growth (22, 133, 174) and physiological development (107, 142, 158, 162) have been made available, and several general theoretical considerations of some of the basic problems involved have been published (27, 45, 113, 120, 163, 165, 166, 170).

Prenatal Development

The genetic die is cast once the sperm enters the ovum and the environmental biogenetic cooperative enterprise is begun. Pregnancy tests have been developed which can ascertain this fact with considerable accuracy in the intact human at an early date. One such test (17) demonstrated an accuracy of 98.7 percent, and another (43) claimed an accuracy of 100 percent when certain conditions were fulfilled.

Prenatal development has been studied by many, and, since Menken and Rock (93) succeeded in fertilizing the human ova in vitro, the

developmental process has been followed from the moment of conception (141), revealing the total developmental picture more clearly than ever before. The development of special fetal segments such as the pulmonary vein (8), the auditory vesicles (11), the cervical vesicles (42), the carpus (121), and the biparietal diameter (68) have been described in considerable detail. Arey (7) developed a new rule for correlating the age of human fetuses with size in inches.

Nieburgs (108), and Nieburgs and Greenblatt (109) developed a smear test for diagnosing the fetal sex during pregnancy. Their evidence indicated that maternal hormone levels change in accordance with the fetal sex and unless the maternal hormones mask those of the fetus the presence of specific smears in the vagina may be used to determine sex. The needed specific estrogenic and androgenic smears were of low incidence which limits the applicability of the method.

The association of maternal rubella (German measles) with congenital defects is still being extensively investigated. Wesselhoeft (168) presented evidence to show that during the first trimester of pregnancy, rubella in the mother was etiological in the production of defects to the eyes, ears, heart, brain, and teeth and in some cases even caused the death of the fetus. Some are so convinced of the relationship that two drastic proposals have been made: (a) that all be exposed to the disease in childhood, and (b) that abortions be legalized for women who have rubella during the first trimester of their pregnancies (168).

Many of the problems associated with the Rh factor are still unsolved, but new facts are continually being brought to light. Potter (125) studied 96 women who had 179 pregnancies following the birth of an earlier infant with erythroblastosis. The picture was an appalling one. Only three of the infants were Rh-negative. Thirty-two of the pregnancies ended in abortion and of the remaining 144 Rh-positive infants with erythroblastosis, 69 were stillborn, 63 died post-natally, and only 12 survived, and of these, three had definite brain damage. Gerver and Day (44) reported on the intelligence quotients of 68 children who had recovered from erythroblastosis fetalis without suffering obvious motor nerve damage. Average IQ impairment was 11.8 when comparisons were made with control siblings. The authors concluded that these outcomes were not due to chance or to the circumstance that the affected child was always younger than his control sibling. They carefully pointed out that their data did not distinguish between a specific effect of the Rh antibody and a nonspecific one such as might be operating in any illness in the newborn period.

Several studies of the influence of maternal diet have been made. In one study employing the method of matched siblings, in order to reduce hereditary and environmental variables (21), it was found that in general birth weight and length of the infant decreased as maternal diet became poorer. Sontag (151) studied the diet history of 203 mothers and found that the observed variations in maternal protein intake failed to produce

detectable changes in the offspring's weight, length, or skeletal ossification at birth, one, six, and 12 months after birth. This was in line with other dietary studies which seemed to show that considerable biological reserves or margins of safety were present. All agreed that severe quantitative and qualitative hunger in the mother was of great consequence for the development of the fetus and the vitality of the newborn child. These considerations, and studies of the effects of wartime diets (6, 36, 149), suggested that the effects of both acute malnutrition and chronic malnutrition as well as the time factor in nutritional studies of pregnancy should be carefully analyzed and studied.

Knaus (76) reported that the size and the weight of the newborn child are largely dependent on the weight of the placenta under normal conditions. Sinclair (148) found that the placental birth-weight ratio decreases linearly with birth weight in the case of full-term births. High placental birth-weight ratios were found in both prematures and postmatures.

Mortality Considerations

The most hazardous period in the life of the infant is the first day of life (105). Twenty-nine percent of all infant deaths in the United States in 1945 were babies under one day of age. The most frequent causes of death were prematurity, pneumonia and influenza, congenital malformations, injury at birth, and diarrhea and enteritis in that order. In 1915 about one out of 10 babies born alive failed to survive the first year of life, but by 1945 this had been reduced to the point that only one out of about 27 infants born alive died before the first birthday. Infant mortality rates in the United States continued to decline in 1946 and 1947.

The infant mortality rate for rural residents was lower than that for urban places with 10,000 to 25,000 population, and with 5000 to 10,000 inhabitants, but was higher than that for large urban cities (104).

Mengert (92) found that approximately 4 percent of fetuses reaching a size and degree of development compatible with extrauterine existence died before, during, or soon after birth. The chief over-all cause was anoxia, and he dogmatically attributed this to the analgesic and anesthetic drugs used to relieve the pain of labor. Hughes (59) took an experimental approach to this problem and found that electroencephalograms of the newborn served as sensitive indicators of the effects of analgesics and anesthetics. His results to date seem very promising. Plattner (124) studied 2910 premature infants and found that approximately 18 percent died. Kerpel-Fronius (71) reported that in Budapest the problem of infant mortality was primarily a social and financial problem.

Sudden and unexpected natural death is chiefly found in male children and rarely occurs beyond the age of three years (130). From 10 to 14 is the golden age of childhood if measured by mortality (12).

Some Factors Conditioning Post-Natal Growth and Development

The effects upon longevity and mortality of premature birth, plural births, and the Rh factor were considered by Dublin, Lotka, and Spiegelman (33). Glaser, Parmelee, and Plattner (48) observed 163 premature infants during a two-year period (1945-1947) at two-week intervals for eight months. The peak of growth was reached during the second and third two-month period. A study of 2426 children whose birth weights ranged from less than five pounds and eight ounces to more than nine pounds and eight ounces (65) revealed that at all ages the birth weight bore a constant relationship to the subsequent physical development.

The body measurements of 96 pairs of brothers were studied to discover familial influences (56). Longitudinal measurements were found to be most alike and nose breadth and ear length and breadth least responsive to the factor of brotherhood. In another study of 186 brothers (55) birth order was found to have no constant influence on adult body form.

Geographic and racial influences upon growth and development were studied by several workers. Children in Okinawa (94) were found to compare unfavorably in head circumference at birth and in height and weight at birth, three years, six years and 10 years with children in France, South Africa, and North America. Shanghai children (106), aged four to 11, who were studied in 1945 were significantly shorter and underweight as compared with children in 1939. Several factors, including the education of children and parents of Aleutian children in matters of nutrition and hygiene, resulted in somewhat better than average growth and development and reduction of serious illness to a minimum (171). In a group of mothers ranging in age from 10 to 54 years (152), the frequency of stillbirths at all ages was found to be significantly higher for a colored population estimated to be 95 percent Negro than for the white population studied. Sixteen different body measurements of 1986 Minnesota schoolboys ranging in age from six to 17, of whom 1102 were of Finnish lineage and 884 of Italian descent, were studied by Matheny and Meredith (91). They found the boys of Finnish descent larger than the boys of Italian lineage at all ages in all measurements except face length and width, and in head width at the upper levels.

Aldrich (3) presented a thought-provoking comparison of laws of the social order and laws of growth and development. Fried and Mayer (40) concluded that socio-emotional disturbance as a cause of growth failure is much more frequent and more extensive than is generally recognized. Kessler and Scott (73) confirmed previous findings of the relation of epiphyseal maturation to birth weight, body length, and sex, but were unable to demonstrate any relation between economic status and milk intake during pregnancy and the diameters of the distal femoral and proximal epiphyses or with roentgenograms of the knees. The effect of wartime conditions on children was shown to be dependent upon the severity of prevailing deprivations (7, 37, 149) and the use made of available food supplies.

In a longitudinal study of the illness experience of 126 normal children (14), it was found that only a small percentage became afflicted with permanent ill health altho every period of childhood had its special health hazards. No constant relation between illness patterns in children and their ordinal position in the family was found by Kingsley and Reynolds (74). Children with diabetes mellitus (15) lagged behind normal children in body size and growth rate during the normal growth period, but continued to grow after the time that growth was usually terminated for the normal child. This growth continued until they attained normal stature. When an adequate diet was available, control of active allergy (24) resulted in remediation of the growth failure caused by the allergy. Wilson and Lubschez (172) studied longevity in rheumatic fever in 1042 children observed over a period of 30 years. Four out of five survived to the age of 10, three out of four survived puberty, and of those reaching the age of 20, 19 out of 20 survived early adult life. The over-all chance of survival to the age of 40 was one out of two. Prolonged separation from the home for institutional care in the cases of 600 children with rheumatic fever failed to produce major adjustment problems or to disturb the integrity of family life (156). This would seem to demonstrate that the manner of doing may outweigh other considerations.

The general problem of the relationship of endocrine conditions to growth and development was dealt with by several individuals (18, 117, 147, 155). Hench and Kendall, in a series of papers (52, 53, 54, 70), reported the epoch-making results of the administration of cortisone (Kendall Compound E) and ACTH in rheumatic arthritis and other diseases. These brilliant approaches to the treatment of certain diseases have opened entire new fields for research and the clinical application of the results of research. It is particularly interesting that the compound in question was first synthesized many years ago and that its practical application was of very recent date.

Dietary and nutritional influences upon growth were studied by a large group of workers (1, 79, 113, 115, 123, 169). One of the most significant outcomes pertained to the effects of restricted caloric intake upon aging and disease (10, 83, 118, 134). A group of experiments showed that animals fed from birth on diets deficient only in calories enjoy an extended life span, accompanied by a lower incidence of tumors and other diseases. In one experiment (10) the incidence of cancer in mice restricted in caloric intake thru their whole life was zero. McCay (83) stated that, in addition to increasing general longevity, such diets may produce less aging of special organs such as the kidneys and lungs. Certainly the general nutritional theory that the bodies of growing boys and girls should be continually supplied with an excess of essential nutrients needs reexamination. *Nutrition Reviews* (118) presented a good brief review of current work in this field.

Extradietary factors, notably the endocrine glands, were found to

exert a profound influence in determining what tissues are actually formed from the available building blocks (117). In the past there has been a tacit assumption that with adequate diets the utilization by the body was the same in all cases, at least from a qualitative point of view. There was important evidence to show that the utilization by the body may vary greatly and this must be taken into consideration in any accurate appraisal or evaluation of growth. Li, Simpson, and Evans (81) found that animals receiving growth hormone showed nearly five times the weight gain of hypophysectomized female rats of the same age that were on the same diet.

Growth—Stature and Weight

Several studies of various aspects of growth as measured by stature and weight were made during this period (29, 34, 35, 41, 47, 49, 65, 100, 106, 138). Edgerton, Britt, and Norman (34) compared ranking and non-ranking contestants in the first annual science talent search with 6730 army inductees under 20 years of age and found them significantly superior to the army sample in stature and weight. The 220 ranking contestants had significantly fewer physical defects than the 1786 non-ranking contestants with the exception of visual defects. Reynolds and Schoen (138) described the resemblances and differences revealed by a longitudinal study of monozygotic triplet boys from eight thru 18 years of age.

Krogman (76) published a handbook which explains how height and weight measurements should be made; and more important how they should be interpreted. This was an excellent presentation of the problem, methods to be used, and evaluative technics. Krogman (77) also discussed the value of the use of the skeleton in estimating morphological maturity. A grid for recording the weight of premature infants (30) was also available.

Adolescent Development

Ellis (37) found that the age range of onset of pubescence may show a variation of several years and that the duration of pubescence seems longest in those reaching this stage early or late. He found an acceleration in growth about six months before the onset of pubescence. Ellis (35) stressed the fact that height and weight curves may go out of date and that maturity level must be considered in evaluating such data. He also found that the earlier maturity of girls was substantiated.

Reynolds and Wines (139) made 557 semi-annual examinations of 49 girls and studied maturation, size, shape, and areolar protrusion of the breasts; development of pubic hair; menarche; and the interrelations of these maturational features. Five different types of maturational extremes were compared and it was promised that subsequent reports would deal

with axillary hair, osseous development, menstrual patterns, differential tissue growth, physiological function, growth of body segments, and endocrine activity during adolescence. Marchetti and Menaker (86) applied several criteria and concluded that the optimum time for having the first child, from a purely obstetrical point of view, was at 16 years of age or less.

Stuart (153) discussed pubescence, differentiating characteristics of early and late pubescence, and factors influencing, or associated with, variability in adolescent maturation which may have significance for health. Stuart also stressed the importance of food and feeding habits for time and degree of growth and for skeletal and sexual development. Several studies have stressed the importance of food and feeding for skeletal and sexual development. This work has been confirmed by the experiments with animals in which great postponement of sexual development followed the administration of diets deficient in caloric content.

Deamer (30) reported that increased rate of growth, at least in boys, may be obtained by the use of sublingual testosterone therapy in the prepuberty period, but that these children will still be small individuals at cessation of treatment. He warned that treatment must not be carried to the point of undue advancement of bone age. He also called attention to possible disadvantages inherent in this method of obtaining an increased rate of growth. Dwarfism in healthy children was also studied by Talbot and others (155) and was judged to be caused in some cases by emotional and nutritional inadequacies (anorexia secondary to emotional disturbances). In view of this the use of testosterone as initial treatment seems very unwise.

Bergman (18) published a differential diagnostic table of sex precocity and the adrenogenital syndrome with an account of 17 urinary ketosteroids which should be of value in the recognition and clinical management of these individuals.

Growth of Body Segments and Tissues

Growth of the human head from birth thru the third month of life was investigated by Ortiz and Brodie (122) in 135 infants. As an aid in the early recognition of hydrocephalus, retarded mental development, and appraisement of the normal infant, Silver and Deamer (146) published graphs of the head circumference of infants. Allen (4) studied the facial growth of children ranging in age from five to eight years. A greater amount of growth was found in the lower facial measurements than in the upper, and the growth was found to be greater in boys than in girls. Valuable information on facial development from 12 to 22 in males was furnished by a Swedish study (19).

Count (26) supplied some exceptionally valuable data on the growth of the brain from the fetal period to adulthood. Particular attention was paid to the question of how brain weight grows with respect to body

weight. French (39) studied brain tumors in children from birth to age 16 and concluded that they occur with equal frequency at all ages thruout childhood.

The diameter and cross-sectional area of the hair of children from birth to maturity was studied by Trotter and Duggins (160). Developmental changes were found to cease at a relatively early age. After the second year no uniformity in trend was found in the index used and after an initial rapid increase in cross-sectional area during the first three years the increase was slow and irregular. Monthly samples were used.

The growth of the human pituitary fossa was studied from the fifth fetal month thru the adult by Francis (38). The length was found to increase very rapidly during the last 24 weeks of the fetal period, but there were no sex differences. Both length and depth measurements showed a rapid growth during the first year of post-natal life and then length accelerated again at puberty. Rasmussen (131) plotted the weight of the 122 normal hypophyses of white children from birth to 19 years of age against stature, and noted concave curves. The weight of the gland plotted against age gave a growth curve which was practically a straight line. The same author (132) also reported on changes in the proportion of cell types in the anterior lobe of the hypophysis during the first 19 years of life and concluded there were no distinct histological cycles that could be correlated with physiological cycles.

Natal teeth occurred approximately once in 2000 births in a study of the phenomena in two Chicago hospitals (89). Median and mean ages as well as standard deviations for the eruption of the first six teeth were furnished by Hurme (63, 64). The statistical material comprised 93,000 children from the northern temperate zone. Stillman (145) plotted maxillary and mandibular curves against age for 38 children from birth to nine years and found that the curves for those with poor occlusion tended to converge or diverge.

Dreizen and others (32) found no apparent difference in the incidence of dental caries between poorly nourished and adequately nourished children or between those receiving a supplement of one quart of milk per day and those not receiving the milk supplement during the period of their study. The relationship of nutrition to dental caries was studied by many groups and individuals (112). Sognnaes (150) made a clinical analysis of certain well established trends in the dental caries incidence which occurred in children in Europe during the past 50 years. This analysis throws doubt upon the sufficiency of oral environmental factors in the causing of dental caries. A marked wartime reduction of dental caries in European children was found. This outcome could not be explained on the basis of an increase in the consumption of any previously demonstrated caries preventing food or food factor. One great difficulty in all caries research is that caries progress at variable rates of speed, and a variable period of latency seems to intervene before the effect of any imposed regimen may be felt.

Massler and Schour (90) found that the dental caries incidence in 162 children aged 10 to 18 years and living in Naples was less than one-half of that observed in children of similar ages in the United States. They concluded that, since these children were for the most part malnourished, the relation between good nutrition and a protective influence against dental caries was not borne out by their study.

Nutrition Reviews (114) published a good general review of the problem of fluorine in relation to dental caries and the *Quarterly Review of Pediatrics* for November, 1949 (128), contained a splendid special section on children's teeth, dental caries, and related problems. Among other topics this issue dealt with the pathology of dental caries, carbohydrates plus lactobacilli as destructive agents, fluoride and caries, nutrition and dental decay, miscellaneous conditions of teeth and gums, and ranges of normalcy in the eruption of teeth.

The use of the skeleton to estimate morphological maturity has been generally accepted. Greulich and Pyle's (51) new atlas will prove invaluable to workers in this field. Abbott and others (1) recommended that carpal and epiphyseal development be used as another index of nutritional condition. Data concerning the lengths of the femur and the tibia from five years until epiphyseal closure were published by Anderson and Green (5). They paid particular attention to the factor of variation in rates of skeletal maturation. The pattern of the development of ossification centers in 1112 single-born infants was presented in tabular form by Christie (23). Kelly and Reynolds (69) published tables giving the order of appearance of ossification centers, appearance of distal epiphyses of long bones, area of carpal bones, measurement of long bones, and other diameters for 305 white and 120 Negro infants assessed at about 28-day intervals during the first year of life. Milman and Bakwin (99) studied ossification of the metacarpal and metatarsal centers as a measure of maturation in children from one to five years of age. A thoro review of the structure of bone, growth of bone, chemical and enzymatic problems of ossification, chemical nature of bone, bone metabolism as studied by means of radioactive isotopes, influence of dietary factors on bone, and influence of hormonal factors on bone was published by Dallemagne (28). Potter and Meredith (126) recommended that biparietal diameters be taken by direct measurement and bigonial diameter be taken from measurements of the posteroanterior roentgenogram in growth studies of the young child. Schmid (143) published data for the time of appearance and for the greatest length and breadth of wrist bones for children from three months to 18 years of age, assessed between the years of 1933 and 1947. Townsley (159) reported on the influence of mechanical factors on the development and structure of bone for fetuses of three, five, seven, and eight months and for infants and children of one, 12, 15, 30, 48, 96, and 120 months.

Reynolds and Grote (137) compared tissue distribution in the male leg with that of the female from birth to maturity. Males exceeded females in

mean breadth of muscle, bone, and total breadth of calf, while females were larger than males in mean breadth of tela subcutanea plus skin, and these differences were pronounced in adolescence and maturity.

Maresh (87) measured 3205 roentgenograms of 71 boys and 57 girls in good health taken during the past 20 years. These data were used to assess the significance of the size of heart by relating the measurements to the basic process of growth and maturation of the individual. Meyer (97) published an equation for the measurement of children's hearts together with a nomogram making it possible to read directly any percentage variation from the normal.

Interrelatedness of Some Growth Phenomena

Norval (110) found that infants who were relatively long for their weight began to walk at an earlier age than the others. She also found that the age at which babies started walking was not significantly related to weight at birth. Length at birth correlated negatively with walking age. Worcester and Lombard (173) were unable to predict leg length at age 16 accurately from leg length, height, and ratio at ages seven or 12.

Blood volumes in normal children varying in age from one to 17 years were found to be related to body weight by a linear equation, to stature by an exponential equation, and to surface area by nonlinear equation of the second degree (101).

Shepherd, Sholl, and Vizoso (144) found the size relationships between body length to be linear between infancy and maturity. Adolph (2) published a chart for mammals by means of which from the value of one characteristic of a mammal 33 others could be roughly predicted. Bayer and Bayley (13) published directions for measuring height and assessing skeletal age for use in predicting height. Gray (50) evaluated three methods of predicting adult stature and found the respective percentage errors to be 2.8 for mid-parent rule; 2.5 for Walford's transform; and 2.0 for Bayley's bone-age.

Muhsam (102) found that prepuberal growth and post-puberal growth in girls were negatively correlated. Correlation patterns for growth in height and weight were found similar, but the compensation for growth in height began one or two years later for that growth in height.

Washburn (167) reported that the use of an ischium-pubis index gave an accuracy of over 90 percent in predicting sex from skeletal remains provided they are from the same racial group. In children the index proved of little use, for the average difference between boys and girls remained at 2 to 3 percent thruout childhood.

Reynolds and Clark (136) found creatinine excretion closely associated with muscle breadth and with bone breadth and very slightly associated with fat breadth. Jones (67) found strength as measured by grip, pull, and thrust positively related to height, weight, chronological age, skeletal age, and popularity. Relationships between strength and measures of intelli-

gence were found to be considerably lower. Relationships with socio-economic factors were found to be negligible. Personality problems stemming from physical status and interpretations and implications for educational programs and for high-school counselors were offered.

Body Build and Body Proportions

Hunt (62) questioned Sheldon's view of somatotype as a simple predominance or balance of one or more of the embryonic germ layers, contending that such an explanation was not entirely adequate. He reported that endomorphy, ectomorphy, and mesomorphy represented the retention or exaggeration of growth phases which reached a peak at the post-natal age of nine months, nine years, and in adolescence respectively. Each might also be produced by variations of growth gradients. The three temperament classifications were also related to various post-natal growth periods. Lasker (78) presented evidence to show that partial starvation may alter somatotype. Reynolds and Asakawa (135) studied a series of 167 children for degree of obesity and established five types: obese, mixed obese, relatively obese, relatively mixed obese, and not obese. They suggested that failure to differentiate types of obesity, and the inclusion of subjects who are not obese may account for conflicting results in studies in human obesity.

Growth of Some Bodily Functions

Norval, Kennedy, and Berkson (111) found that the blood sugar of 51 normal infants showed an average increase of 2.8 mg. per 100 cc. per day during the first six days of life and that there was no evidence of stabilization of blood sugar during this period. The need for accurate figures on energy expenditures of children in connection with nutrition studies prompted Taylor, Pye, and Caldwell (157) to study the energy expenditures of seven boys and 12 girls ranging in age from nine to 11 years while they were standing, drawing, and dressing and undressing in a respiration chamber. Gesell (46) reported on the developmental aspects of vision.

Several studies of the electrocardiograms of young children and infants (88, 154, 161) showed that special characteristics pec ar to youth were present and that these phenomena were most evident in the youngest children. The subjects used were normal children, so the deviations found could not be considered indicative of future pathology especially in view of the fact that they varied directly with age, diminishing as the children grew older. These highly interesting developmental facts should prove of great value in assessing heart conditions in children.

It is apparent that electroencephalography has been widely used during this period in studies of child development (57, 66) for the following purposes: (a) for the establishment of normal patterns for various age groups (58, 61, 66); (b) for the localization of focal cortical abnor-

malities (25, 60, 119); (c) for the study of cerebral electrical dysrhythmias associated with epilepsy (80); (d) for the study of special serious behavior problems (98); and (e) for the determination of the effects on brain waves of various stimuli and psychologic states (59). In the future, encephalography may well bear additional important fruit when it is applied to the study of learning and problem-solving types of behavior.

Appraisal of Physical Status and Growth

Meredith (95) developed an anthropometric program for schools wherein it is not considered practicable to do more than measure height and weight. (Ordinarily the minimum routine of anthropometry involves body weight, standing height, hip width, chest circumference, leg girth, and subjective ratings of the thickness of two selected folds of skin and subcutaneous tissue.) He also (96) provided school health workers with measurement and rating equivalents for thickness of skin and subcutaneous tissue in two regions; above the ilium and below the scapula, as well as tables of equivalents for normal use covering the age period from four to 18 years for each sex. Cowden (27) published some simplified methods of fitting certain types of growth curves.

The Wetzel Grid records height-weight-age data in graphic form and attempts to evaluate the child with reference to his own age-peers and to his own unique biogenetic endowment. Krogman (70) recommended the use of the Wetzel Grid Technic in connection with height-weight measurements. The newly developed Red Graph offers a method whereby the symmetry of skeletal status and progress during growth may be quantified and interprets roentgenograms graphically. Several experimenters (85, 127) urged its use as a method of determining the symmetry of status and progress during growth. Children who are often grouped into a single category by the Wetzel Grid technic may be separated by the X-ray findings used in making the Red Graph. Only in this manner can children who are small because of their genetic inheritance be separated from those who are small because of inadequate nutrition (103). The Red Graph makes use of the most advanced bone as an indicator of the child's potential optimum development, provided this advanced bone is not by chance greatly exceeding a desirable speed of growth for that child. Great width of the Red Graph at any point indicates a lack of developmental symmetry, the causes of which should be investigated. Just how such judgments can be made was not made clear. Moreover, the evidence justifying the assumption that all the bones in the body should develop at the same rate was not presented.

The Todd Graph and the Red Graph differ in that the Todd Graph plots an average of the maturities of the functional parts of the body as revealed by the roentgenogram while the Red Graph plots both the most advanced, lagging, and average parts. Greulich (51), continuing Todd's work, accepted the Red Graph as a useful device.

Physical and Physiological Influences on Mental Growth

Some of the original promise involved in the use of glutamic acid to improve mentality has not been fulfilled. Zimmerman and his group (129, 175, 176) continued to report success with its administration, but the value of glutamic acid as a therapeutic agent in mental retardation has not been universally accepted (9, 116, 164). Some well planned and controlled experiments have given negative results. Loeb and Tuddenham (82) carefully selected their subjects, and, using the method of covariance, found no significant differences between their control and experimental subjects. They used several measures of mental status, the Stanford-Binet (Form L before and M after), the Cornel-Coxe Performance Ability Scale, the Porteus Maze, the Thurstone and Thurstone Primary Mental Abilities, and the Rorschach. They expressed the conviction that the differences between their results and those of Zimmerman may be accounted for by differences in degree of control, in design of the investigation, and in the nature of the statistical analysis of the outcomes. Kerr and Szurek (72), and McCulloch (84) also failed to confirm the beneficial effects of glutamic acid. To date, the preponderance of evidence seems to indicate that if the experiments were expertly designed and controlled, and the results carefully evaluated, the verdict is "not proven."

Another pioneer approach to the problem of mental deficiency was that of Beck, McKhann, and Belnap (16), who developed a surgical procedure to produce redistribution and increase of blood flow to the brain. At the time of writing their paper 11 patients had been operated upon, but the paper reported the results for only four of these. These experimenters were enthusiastic about the outcomes, but evaluation must certainly await further data.

Denhoff, Holden, and Silver (31) administered Tolserol to 16 children ranging in age from three to eight years with cerebral palsy. Five methods of evaluation were used, neurologic, orthopedic, psychomotor, behavior, and laboratory (toxemia). No consistent, outstanding, over-all improvement was found.

The effect of added thiamine on growth, vision, and learning was investigated by using 36 pairs of identical twins over an original period of four and one-half months with an added four and one-half months period for 25 of the pairs of twins (140). No statistically significant gains were found in any of the measures used; these measures were weight, height, manual dexterity, prolonged memory tests, vision, intelligence, reasoning, arithmetic, rote memory, and code substitution.

These studies of physical and physiological influences on mental growth and function seem to have produced no brilliantly positive results. This does not mean that these experiments are worthless, for, on the contrary, a very great merit inheres in their opening of new areas for exploration, and in their stimulation of further research in the field of

nerve and brain metabolism. Approaches such as these should be greatly encouraged. Intrinsically they are far superior to the inertia engendered by acceptance of the fatalistic doctrine that genetic considerations irrevocably predetermine matters once and for all.

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[1] Corrected to January 1, 1951. Report errors immediately to the secretary-treasurer.

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Gex, R. Stanley
Good, Carter V.
Harry, David P., Jr.
Heck, Arch O.
Hendrickson, Gordon
Herrick, John H.
Hill, George E.
Holy, T. C.
Horrocks, John E.
Hyatt, Ada V.
Jackson, Reid E.
Kinzer, John Ross
Klohr, Paul R.
Knower, Franklin H.
Lehman, Harvey C.
McFall, Kenneth H.
McKelvey, Frederick H.
McKim, Margaret G.
Mathews, Chester O.
Morton, R. L.
Murdoch, Bernard C.
Pounds, Ralph L.
Pressey, Sidney L.
Price, Mrs. Hazel H.
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Spayde, Paul E.
Toops, Herbert A.
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Whitesel, John A.
Wood, Ray G.

Oklahoma

Gunn, Helen V.
Hansen, Harvey C.
Pauly, Frank R.
Rinsland, Henry D.

Oregon

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Maaske, Roben J.

Pennsylvania

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Cattell, Psyche
Desing, Minerva F.
Detchen, Lily
Donohue, Francis J.
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Flanagan, John C.
Fritz, Ralph A.
Gordon, Hans C.
Grizzell, E. Duncan
Hatcher, Hazel M.
Heaton, Kenneth L.
Jones, Arthur J.
Jones, Lloyd M.
Manwiller, Charles E.
Masters, Harry V.
Morneweck, Carl D.
Munson, Saron E.
Myers, Garry C.
Novak, Benjamin J.
Preston, Ralph C.
Seegers, J. Conrad
Tate, Merle W.
Trabue, M. R.
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Rhode Island

Thorp, Mary T.

Tennessee

Broom, M. E.
Capehart, Bertis E.
Cureton, Edward E.
Davis, Robert A.
Harap, Henry
Kent, Druzilla Crary
Pierce, Truman M.
Redd, George N.
Roberts, S. Oliver
Stanley, Julian Cecil, Jr.
Waters, Eugene A.

Texas

Barnett, Albert
Chapman, A. L.
Hendricks, Jake J.
Jacobs, Robert
Manuel, Herschel T.
Martin, Edwin D.
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Sells, Saul B.
Shea, James T.
Singleton, Gordon G.
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Utah

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Virginia

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Wisconsin

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Jensen, Kai
Leary, Bernice E.
O'Brien, Cyril C.
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Theisen, W. W.
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Willing, Matthew H.

Wyoming

Reusser, Walter C.

Foreign

Cunningham, K. S.
Orata, Pedro T.
Schonell, Fred J.
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Index to Volume XX

Page citations are made to single pages; these are often the beginning of a chapter, section, or running discussion dealing with the topic.

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